MEA 2015–2016

Science Grade 8

The table below shows the entire eighth-grade science test design. Scores are based on common items only, half of which are released and can be found in this document.

Test Design

Content Area	Common		Field Test Items		Total Items per Student		Base Testing Time	Points
	MC	CR	MC	CR	MC	CR		
Science	40	4	8	1	48	5	105 min.	56

Each item on the MEA measures a content standard of Maine's 2007 *Learning Results*.

Science Content Standards Assessed on the MEA

D. The Physical Setting
1. Universe and Solar System
2. Earth
3. Matter and Energy
4. Force and Motion

E. The Living Environment
1. Biodiversity
2. Ecosystems
3. Cells
4. Heredity and Reproduction
5. Evolution

Item Information Chart

Please refer to the item information chart on the next page for in-depth information on each science released item. The released item numbers in the chart correspond to item numbers in the practice test and on the MEA Item Analysis Report.

Constructed-Response Scoring Guides

A constructed-response scoring guide includes score point descriptions used to determine the score. Training notes that follow the scoring guide provide in-depth descriptions or particular information also used to determine the score.

Student Work

At least one sample student response is provided for each score point with annotations that explain the reasoning behind the assigned score.

Grade 8 Science Released Item Information

Released Item Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Practice Test Page Number	1	1	1	1	2	2	2	3	3	3	4	4	4	5	5	5	6	6	6	6	7	8
Content Strand (Maine 2007 *Learning Results*)	E5	D1	E3	E1	E1	D3	E1	E5	D4	D3	E5	D2	D1	E3	D1	D2	E3	D2	D1	D3	D4	E2
Depth of Knowledge Code	2	2	2	2	2	1	1	2	2	2	2	2	2	2	2	2	1	1	1	1	3	2
Item Type	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	CR	CR
Possible Points	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	4
Answer Key	C	B	A	D	C	C	B	A	D	A	D	B	D	C	A	C	B	D	C	A		
% Who Chose A or Earned 1 Point	8	3	66	8	10	19	3	53	15	49	21	15	10	21	77	7	34	3	18	74	38	7
% Who Chose B or Earned 2 Points	3	85	8	17	12	18	84	10	15	22	9	47	11	18	8	3	51	6	5	18	16	6
% Who Chose C or Earned 3 Points	86	6	12	12	66	56	8	32	25	13	15	13	11	41	5	82	7	2	73	5	34	31
% Who Chose D or Earned 4 Points	3	6	14	63	12	7	5	5	44	16	54	25	68	19	9	8	8	89	4	3	8	40
Statewide Average Student Score																					1.2	2.4

Content Strands: See "MDOE Regulation 132–*Learning Results: Parameters for Essential Instruction*" at http://www.maine.gov/education/lres/pei/index.html.

Item Type: MC = multiple choice, CR = constructed response

Answer Key: the letter of the correct answer choice

Constructed-Response Item 21

21 The table below shows the densities of three materials and the speed of sound through each material.

Speed of Sound through Different Materials

Material	Approximate Density (g/mL)	Speed of Sound (km/hr)
Water	1.0	5,336
Air	0.00128	1,236
Aluminum	2.7	18,000

a. Based on the data in the table, describe the relationship between the speed of sound through a material and the density of the material. Include evidence from the data to support your response.

b. Describe the scientific concept that explains how sound waves interact with particles of matter.

Scoring Guide for Constructed-Response Item 21

Score	Description
4	The response demonstrates a thorough understanding of the force of gravity, the motion of objects, the properties of waves, and the wavelike property of energy in light waves. The response draws a conclusion about the relationship between the speed of sound waves through a material and the density of the material, and describes the scientific concept for how sound waves interact with particles of matter. The response has no errors or omissions.
3	The response demonstrates a general understanding of the force of gravity, the motion of objects, the properties of waves, and the wavelike property of energy in light waves. The response has an error or omission.
2	The response demonstrates a limited understanding of the force of gravity, the motion of objects, the properties of waves, and the wavelike property of energy in light waves. The response has errors or omissions.
1	The response demonstrates a minimal understanding of the force of gravity, the motion of objects, the properties of waves, and the wavelike property of energy in light waves. The response has one correct piece of information.
0	The response is incorrect or irrelevant to the skill or concept being measured.
Blank	No response.

Training Notes for Constructed-Response Item 21

Responses may include:

a. Based on the data in the table, a reasonable conclusion is that sound waves travel faster through denser materials. For example, sound waves travel 18,000 km/hr through aluminum, which has a density of 2.7 g/mL, but only 5,336 km/hr through water, which has a density of 1 g/mL. Similarly, sound waves travel only 1,236 km/hr through the least dense material in the table, air.

b. Sound waves travel through materials by causing a disturbance in the particles of the material. The closer the particles of the material, the more easily they bump into one another and allow the disturbance to travel through them.

a. According to the data in the table, sound waves move faster when traveling through a denser material. IF the density increases, so does the speed of sound. This is shown in the table because water is denser than air, and sound moves almost five times faster in water than air. Aluminum is much denser than water, and sound moves almost three times faster through aluminum than water.

b. Sounds move much faster in denser materials because sound needs tightly packed atoms to travel quick. Denser objects have tightly packed atoms. Sound needs that to move fast because sound is essentially a vibration. A vibration will hit atom to atom. IF the atoms are spaced apart, like in air, then sounds will have a harder time moving through it, whereas tightly packed materials, like aluminum, will easily let sounds and vibrations move through it.

Summary annotation statement:

a. The response accurately concludes that sound waves travel faster through denser materials, and correctly makes comparisons between air, water, and aluminum using the data in the table.

b. The response correctly discusses how molecular movement transmits sound ("vibrate" is acceptable at the 8th grade level), including how atoms must hit each other in order to transmit sound.

Based on the table, it shows that the greater the density of a substance, the faster sound goes through it. Air has a very small density and therefore speed cannot travel through it very fast. Water has a small density of 1 and so sound still travels fairly slow through it, but faster than in air. Aluminum has a bigger density of 2.7 and so sound can travel pretty fast through it. Sound waves move through particles to transfer the sound. The closer the particles are to each other, the faster sound can travel through it. Air is a gas, which means it's particles are pretty spread out, so sound waves can't move through each particle quickly. Water is a liquid, which means it's particles are still spread out, but closer together than in a gas. Since the particles are closer together, sound waves can move through it quicker. Aluminum is a solid, so it's particles are all bunched together. Since the particles are all together, sound waves can move through it pretty quickly.

Summary annotation statement:

Full credit was awarded in part a. Part b discusses density and how it affects the travel of sound waves, but does not discuss particle displacement (the "bumping" into one another that allows travel).

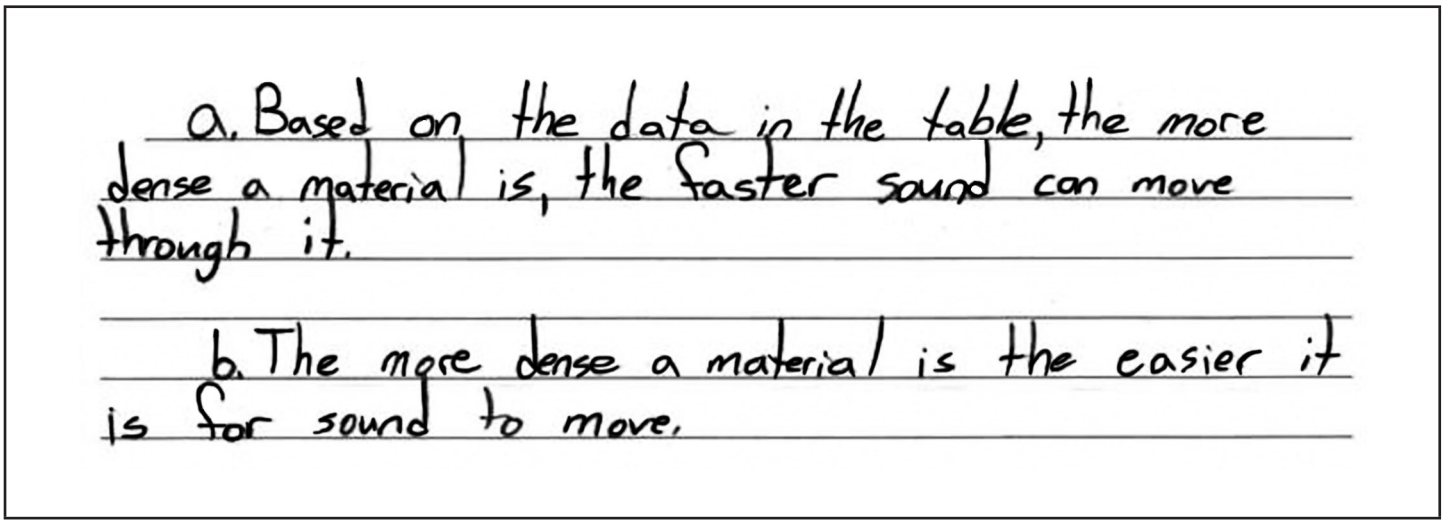
a.) The more density a material has, the faster the speed of sound is. Air is 0.00128 g/mL density and the speed of sound is 1,236 km/hr. Water density is 1.0(g/mL which makes the speed of sound more with 5,336 (km/hr) once again Aluminums density is 2.7(g/mL) whic makes the speed of sound even faster traveling at 18,000 (km/hr).

b.) Particles of matter disperse out into a wave that travels and allows people to hear, fast or slow. Its the speed of sound.

Summary annotation statement:

Full credit was awarded in part a. Part b is incorrect. Particles do not disperse into a wave that travels.

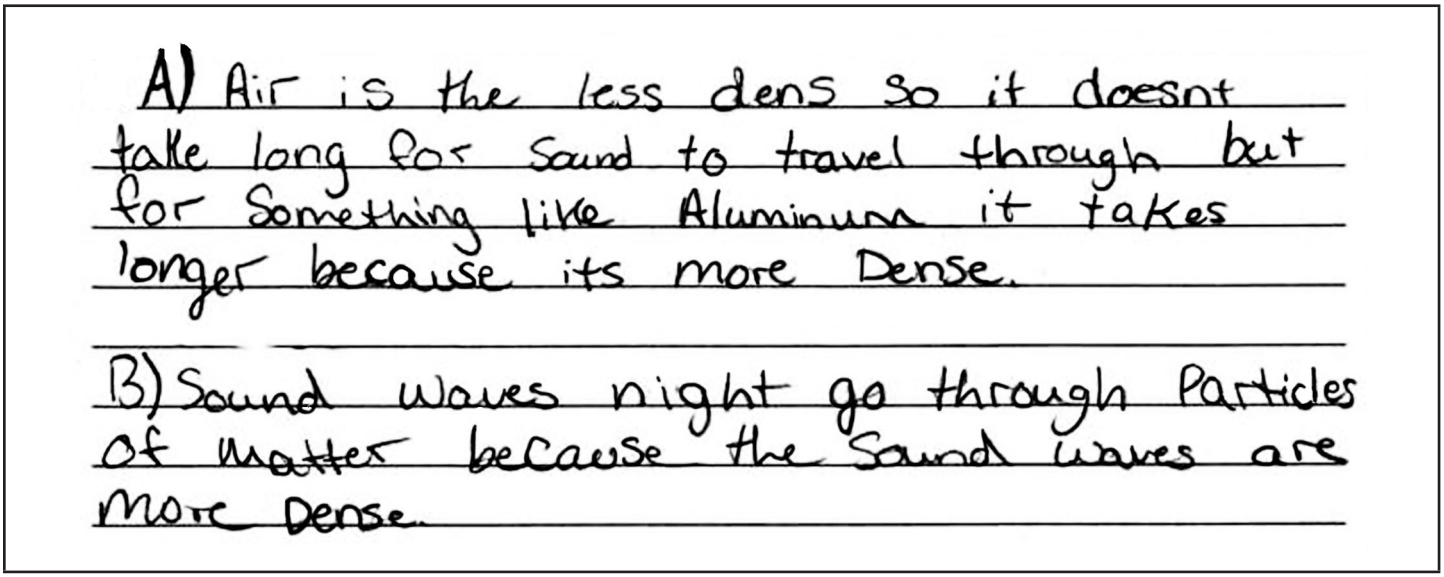
Sample 1-Point Response with Annotations for Constructed-Response Item 21



Summary annotation statement:

Minimal credit was given in part a for a correct conclusion, however no evidence is provided in support. Part b is a vague description and "easier . . . to move" does not mean faster.

Sample 0-Point Response with Annotations for Constructed-Response Item 21


A) Air is the less dens so it doesnt take long for sound to travel through but for Something like Aluminum it takes longer because its more Dense.

B) Sound waves night go through Particles of matter because the Sound waves are more Dense.

Summary annotation statement:

This answer does not demonstrate a creditable answer. It shows no understanding of the information in the table.

Constructed-Response Item 22

22 The picture below shows a tropical rain forest.

In each biome, plants and animals compete for resources.

a. List **three** resources that organisms compete for in a tropical rain forest.

b. For each resource listed in part a, give an example of how two organisms compete for that resource.

Scoring Guide for Constructed-Response Item 22

Score	Description
4	The response demonstrates a thorough understanding of resources that plants and animals compete for in a tropical rain forest. The response lists three resources that organisms compete for, and for each resource gives an example of how two organisms compete for that resource. The response has no errors or omissions.
3	The response demonstrates a general understanding of resources that plants and animals compete for in a tropical rain forest. The response has one error or omission.
2	The response demonstrates a limited understanding of resources that plants and animals compete for in a tropical rain forest. The response has errors and omissions.
1	The response demonstrates a minimal understanding of resources that plants and animals compete for in a tropical rain forest. The response is minimal.
0	The response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response.

Training Notes for Constructed-Response Item 22

a. Examples of Resources:

- sunlight
- food
- nutrients in soil
- water
- shelter
- mates

b. Examples of Competition for Resources:

- Plants compete for sunlight for photosynthesis by growing taller or requiring less light.
- Animals compete for space by having different requirements, claiming territory or fighting over territory.
- Animals compete for food by using strategies like running, fighting, or taking advantage of an adaptation.
- Soil is poor in a tropical rain forest, so plants compete for nutrients by extending out roots or using other adaptations to gain nutrients.
- Plants and animals compete for water by fighting or using special adaptations.
- Animals compete for mates by fighting and displaying.

Note: Responses may give specific animals or plants, or examples other than the ones given.

Note: For a score of 4, a response must reference a specific organism or type of organism.

Part a is worth 3 points and part b is worth 3 points, for a combined total of 6 possible points.

Score conversion
6 pts = 4 score
4–5 pts = 3 score
2–3 pts = 2 score
1 pt = 1 score

Sample 4-Point Response with Annotations for Constructed-Response Item 22

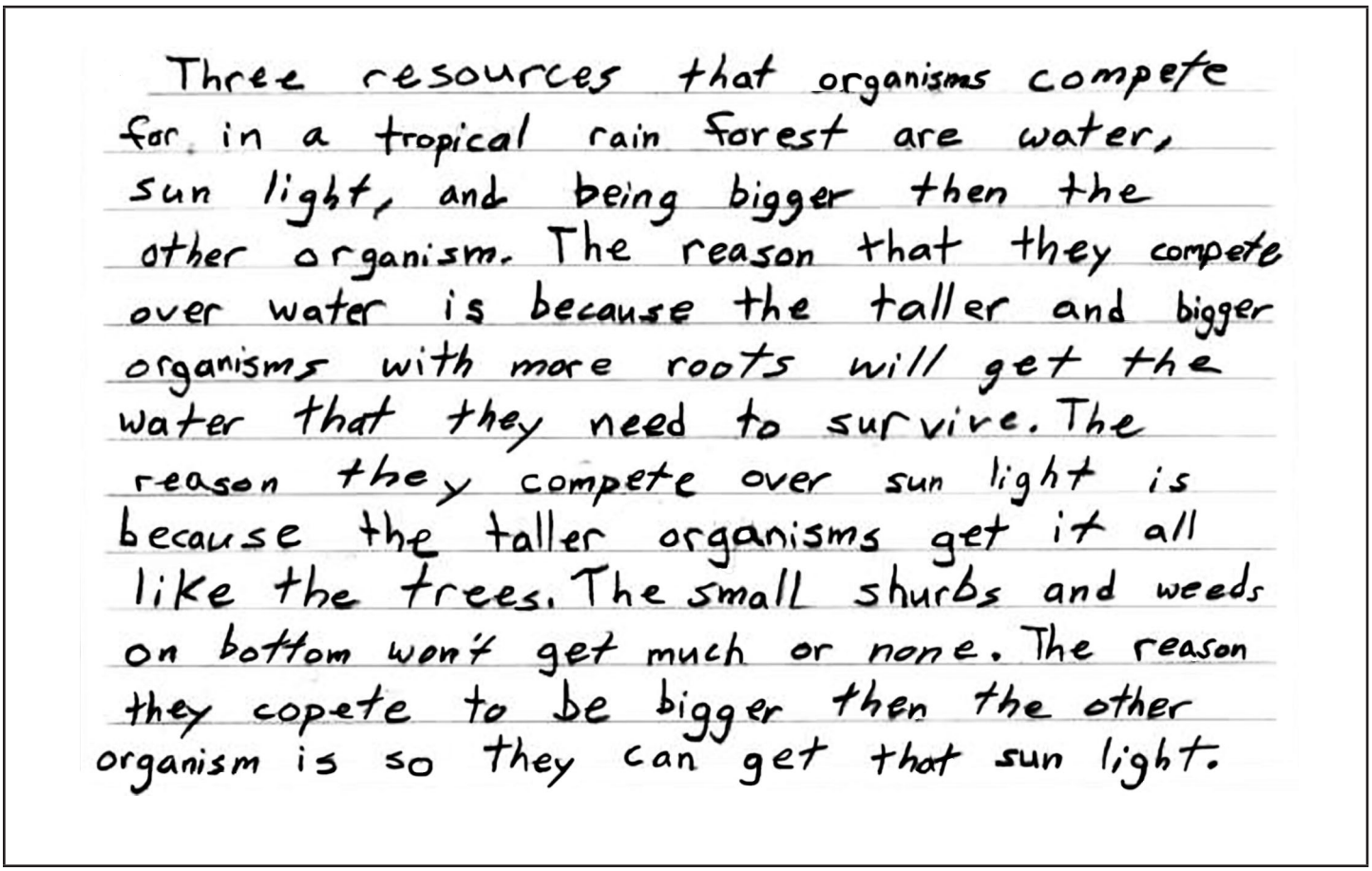
a. In a tropical rainforest organisms compete for sunlight, rain water, and prey.
b. Sunlight - vines grow up the side of trees to steal the sunlight.
Rain water - Some plants have little cups or pockets to steal water from getting to the soil.
Prey - Two birds may attack eachother for a worm.

Summary annotation statement:

Part a: Sunlight, water, and food (prey) – 3 pts; Part b: Liana vines climb trees to get sunlight, bromeliads growing on trees store water in central pools, and birds fight over a worm – 3 pts.

6 pts. total = 4 score.

Sample 3-Point Response with Annotations for Constructed-Response Item 22

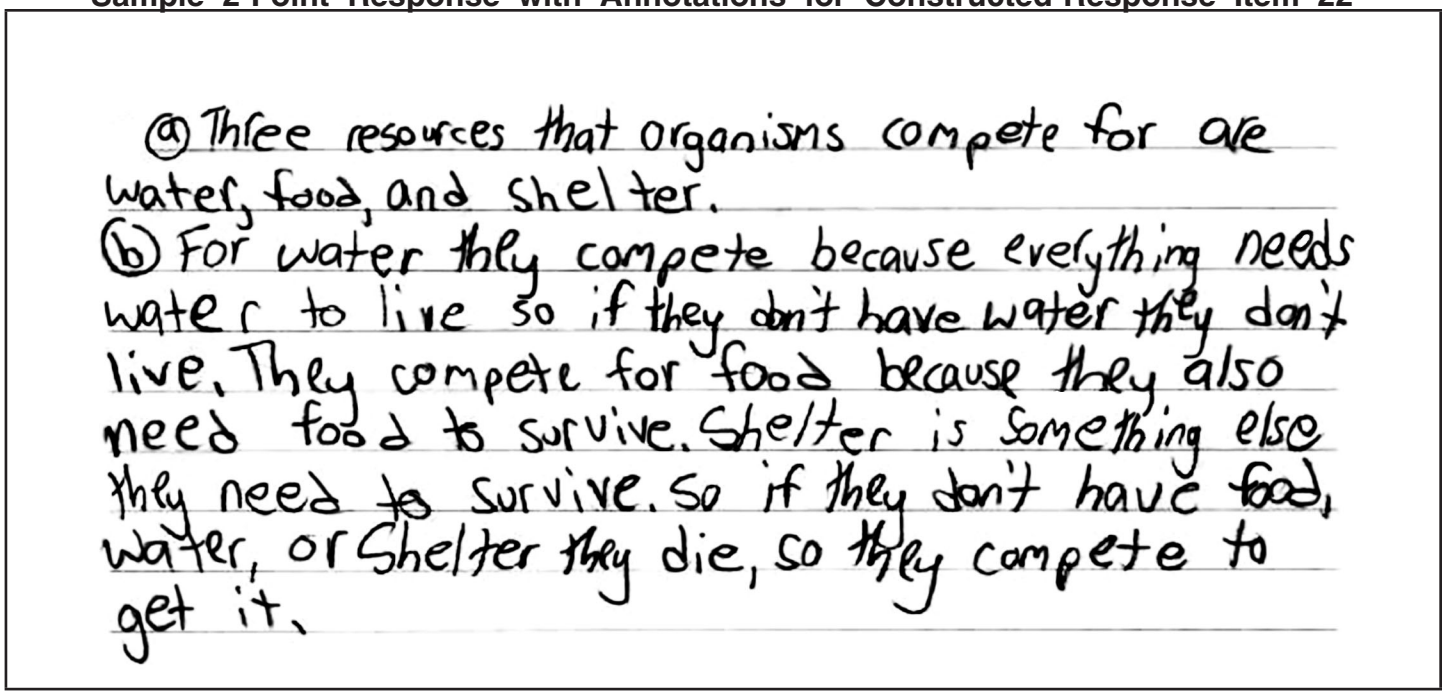


Three resources that organisms compete for in a tropical rain forest are water, sun light, and being bigger then the other organism. The reason that they compete over water is because the taller and bigger organisms with more roots will get the water that they need to survive. The reason they compete over sun light is because the taller organisms get it all like the trees. The small shurbs and weeds on bottom won't get much or none. The reason they copete to be bigger then the other organism is so they can get that sun light.

Summary annotation statement:

Part a: Sunlight and water – 2 pts; Part b: Roots spreading out for water and growing taller for sunlight – 2 pts.

4 pts. total = 3 score.

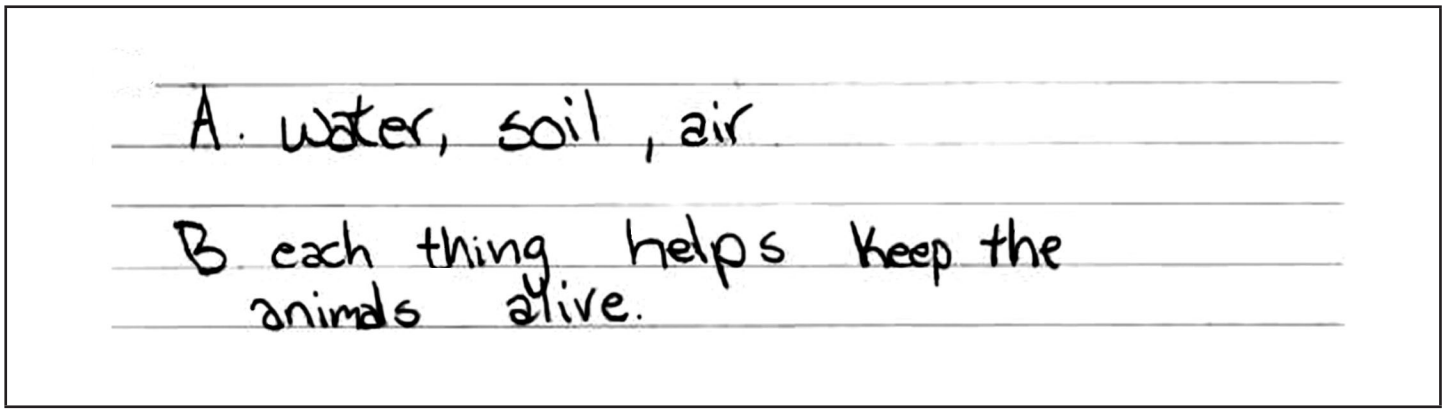


Summary annotation statement:

Part a: Food, water, and shelter – 3 pts; Part b: This explanation is insufficient. It makes no mention of how the organisms compete. – 0 pts.

3 pts. total = 2 score.

Sample 1-Point Response with Annotations for Constructed-Response Item 22

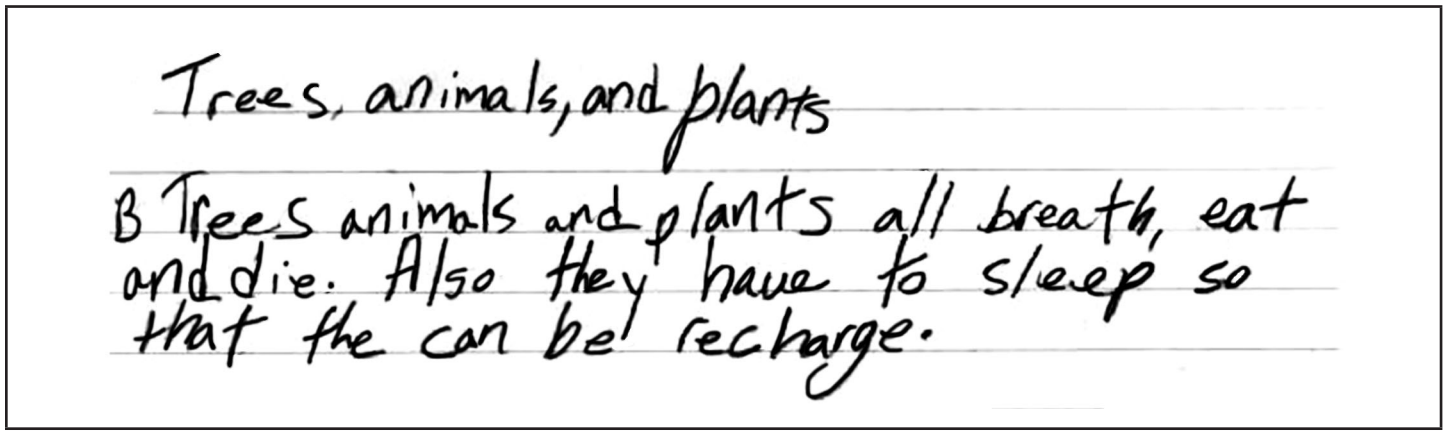


Summary annotation statement:

Part a: Water was accepted, but soil and air were not, because there was no mention of nutrients or space. – 1 pt; Part b: Received no credit. – 0 pts.

1 pt. total = 1 score.

Sample 0-Point Response with Annotations for Constructed-Response Item 22



Summary annotation statement:

No credit was awarded here. – 0 pts.

0 pts. total = 0 score.